Student Number _____ Stu

University of Saskatch

EE 352 Communication Systems I

Quiz #1 – Jan.30/2003

Time: 20 minutes

Permitted: - text, printed notes, student's own *hand-written* materials
Use the space below each question for your answer.

2 1
3 0
4 1/2
5 1
6 3

6 1/2 / 10

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*1. Complete the following drill problem (1 point)

Drill Problem - Amplitude Modulation - For a carrier signal $c(t)=100V\cos 2\pi 20000t$ and the following modulation signals, determine the sinusoidal component amplitudes (in volts) and component frequencies (in kHz).

Modulation Signal	A1	F1	A2	F2	A3	F3	A4	F4
2V cos2π4000t	100	16	100	24				
4V cos2π11000t	200	9	200	31				
2V + 4V cos2π23000t	200	3	200	20	200	43		
cos2π4000t + cos2π8000t	50	12	50	16	50	24	50	28
Checksum	550	40	550	91	250	67	50	28

*2. When viewed from the end of the positive time axis, which way does the vector $e^{j\omega t}$ rotate? (1 point) counter clockwise

*3. A rms responding meter reads 1.5 volts when measuring a white noise source that has bandlimited by a 15 kHz lowpass filter. Estimate the meter reading when the filter cutoff frequency is reduced to 5 kHz. (1 point)

4.5 volts X

*4. An amateur radio signal traveling on a 50 ohm co-axial cable has sinusoidal waveform with peak to peak voltage 7.07 volts. What is the signal level in dBm and dBV. (2 points)

$V_{RMS} = \frac{7.07}{\sqrt{2}} \approx 5V$

$dBV = 20\lg\left(\frac{5V}{1V}\right) = 13.98\ dBV$ X

$P = \frac{5V^2}{50\Omega} = 0.5\ W$

$dBm = 10\lg\left(\frac{0.5W}{1mW}\right) = 26.99\ dBm$ X

*5. In words, explain the advantages/disadvantages of the following amplitude modulation formats. (2 points)

i) DSB-TC.

advantage: it is easy to do and can be demodulated cheaply with a diode detector. ✓

disadvantage: It is not very efficient to transmit the carrier. ✓

ii) DSB-SC.

advantage: you gain efficiency by not having a carrier. ✓

disadvantage: you need to have more expensive demodulating devices. details, - constraints ?

iii) SSB-SC.

advantage: very efficient because there is no carrier and you have only half the bandwith to transmit. ✓

disadvantage: de modulation equipment is more expensive and you are only allowed a 7 Hz gap between the LSB and the USB. ← why does this happen ?

iv) VSB-TC.

advantage: with the amount of bandwith needed and allows for some error in demodulation X

disadvantage: it take alot of power to transmit and demodulation is expensive.

*6. A television receiver is tuned to channel 6 which has video carrier at 83.25 MHz and audio carrier at 87.75 MHz. The TV receiver uses a superheterodyne system that results in video IF carrier at 43.75 MHz and sound IF carrier at 39.25 MHz. (3 points)

i) What is the local oscillator frequency when tuned to channel 6 ?

ii) What are the video and sound image frequencies ?

i) $f_{LO} = f_{IF} + f_{RF}$

$= 43.75\,MHz + 83.25\,MHz$

$f_{LO} = 127.0\,MHz$ ✓

ii) $f_{image} = f_{IF} + f_{LO}$ ✓

$= 43.75\,MHz + 127.0\,MHz = 170.75\,MHz$ for video

$f_{image} = f_{IF} + f_{LO}$ ✓

$= 39.25\,MHz + 127.0\,MHz = 166.25\,MHz$ for audio

3

END